

THE IMMATURE INSTARS AND BIOLOGY OF THE CRANE FLY
GENUS *BRACHYPREMNA* OSTEN SACKEN
(DIPTERA: TIPULIDAE)

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Abstract. The egg, larva and pupa of the crane fly *Brachypremna dispellens* (Walker) from Florida and of an incompletely reared species of *Brachypremna* from Peru are described and illustrated, with brief comments concerning the habitats and behavior of the larva. Comparisons are made with the immature instars of other Tipulinae, and the phylogenetic position of this primarily neotropical genus is briefly discussed. This paper represents the first detailed descriptions and illustrations of the semiaquatic larva and the first complete treatment of the pupa for *Brachypremna*.

Key Words: *Brachypremna*, crane fly, larva, pupa

The immatures of tipuline crane flies are poorly known despite their great ecological (and sometimes economic) importance (Alexander 1920, Pritchard 1983). While the larvae and pupae of over 40% of the described genera and subgenera of Tipulinae are in some part known, this knowledge is derived from only four percent of the species. Our ignorance is proportionally greater when examining just the Neotropical fauna; of the 29 genera and subgenera of Tipulinae that occur there (Alexander and Alexander 1970), we know the immatures for only 6 of these groups (21%), and this derived from less than one percent of the species! This paper, describing the immatures of two species of the tipuline genus *Brachypremna* Osten Sacken, is a small contribution toward rectifying this lack of knowledge.

The genus *Brachypremna* has an essentially Neotropical distribution; of the 38 species, 35 are strictly Neotropical, with one widespread American species, *B. dispellens* (Walker), extending from Brazil northward

to Illinois and New Jersey (United States) (Alexander 1965), and two species occurring in Australia (Oosterbroek and Jonas 1989). The immatures of only *B. dispellens* were previously known: the pupa was incompletely described and illustrated by Alexander (1920) and the larva was diagnosed in a key (Alexander and Byers 1981).

Recently, we were able to collect and rear numerous larvae of *Brachypremna dispellens* from Florida, and one of us (JKG) collected and incompletely reared another species of *Brachypremna* from Peru. We provide here the first complete descriptions and illustrations of the immatures for these two species in the genus, as well as additional information regarding the biology and behavior of the larvae. Terminology follows that of Byers (1961) and Gelhaus (1986).

Brachypremna Osten Sacken

Generic diagnosis. The immature stages of *dispellens* and the undetermined species from Peru are very similar (detailed descrip-

tions follow this generic treatment, with the most distinctive features listed here):

Larva: Thoracic segments with short, brown pile, contrasted with elongate and abundant, mostly reddish-brown hairs on posterior metathorax and abdomen (hairs usually covered with debris) (Fig. 6); abdominal hairs laterally forming longitudinal fringe (Figs. 6, 10) and transverse band ventrally on segment VIII (Fig. 10); each abdominal segment with about 6 annulations; minute dark spiracles laterally on I–VII; spiracular disc small, with six short spiracular lobes, dorsal pair of lobes scarcely evident (Fig. 9); lateral and ventral pairs of lobes short and extensively darkened, each with large translucent spot; spiracles nearly quadrate in outline; anal papillae absent, but a pair of oval, raised membranous areas close behind hairs on segment VII (Fig. 10).

Pupa: Sheaths of maxillary palps short and only slightly curved overall, not recurved (Fig. 12); thoracic respiratory horn relatively short; mesonotum with three pairs of large tubercles (Fig. 11); abdominal spines generally slender, those of genital segment particularly well-developed dorsally (Figs. 14, 15), segment also with only two pairs of ventral spines.

Discussion.—The larva of *Brachypremna* is unlikely to be confused with that of any other tipuline genus. Although as noted by Rogers (1949), the larva of *Brachypremna* does bear a superficial resemblance to that of *Tipula* (*Schummelia*) (Gelhaus 1986, Figs. 93, 98, 99), it is easily distinguished from all tipulines, including *Tipula* (*Schummelia*), by the presence of a longitudinal abdominal hair-fringe on each side, the lack of anal papillae and the contrast in length between the thoracic and abdominal hairs. The pupa of *Brachypremna* differs less from other tipulines, but the apex of the maxillary palpal sheath is only slightly curved, not strongly recurved, which serves to separate it from pupae of most New World tipuline genera, except *Leptotarsus* (*Longurio*) and *Megistocera*. Alexander 1920:

977 lists *Holorusia* (in the generic key for pupae of Tipulinae) as also having only a slightly curved sheath, but the description and illustration (Fig. 497) indicate a strongly recurved one; in addition, all specimens of *Holorusia* we have examined have a strongly recurved sheath. In all other respects, however, these two genera are unlike *Brachypremna* in the pupal stage, including possessing extended respiratory horns (equal to or far exceeding the length of the wing sheaths), and small inconspicuous abdominal spines.

Unlike the pupal head illustrated in Alexander (1920: Fig. 474), specimens of both species of *Brachypremna* showed the apices of the antennal and maxillary palpal sheaths closely approximate (Fig. 13), and the sheath of the labium narrowly divided medially. The posterior spiracles of the pupa are not recessed as seen in some other Tipulinae (e.g. *Dolichozepea*) but, as noted by Byers (1961), a spiracular yoke is nonetheless present in *Brachypremna*.

Relationships.—The generic relationships of the Tipulinae are poorly known, and the few attempts at groupings have been made without justification or lack discrimination between ancestral and derived features (e.g. Alexander 1965). Although *Brachypremna*, *Megistocera* and *Dolichozepea* have sometimes been grouped in the subtribe Dolichozezaria (e.g. Alexander 1920), this is based on only a general similarity of the adults, and is not supported by an examination of the immature stages (Rogers 1949). The adults of *Megistocera* and *Brachypremna* do share some similar features of wing venation, and the pupae have slightly curved maxillary palpal sheaths, but the latter character state, at least, may be transitional between a short, straight sheath (found in the Limoniinae and Cylindrotominae) and the strongly recurved sheath found in most of the Tipulinae. This character interpretation also correlates with the probable phylogenetic position of these two genera, along with others, as being gen-

erally "primitive" within the Tipulinae as a whole (Alexander 1965, Gelhaus, unpublished data), and *Brachypremna* itself may represent an early, and isolated, lineage of the Tipulinae. The phylogenetic position of *Brachypremna* will remain questionable until many more of the Southern Hemisphere genera become known as immatures.

Brachypremna dispellens (Walker)

Alexander (1920): 984–985, pupal description, Figs. 474–477 (head, respiratory horn, leg sheaths, male caudal sheaths); Alexander and Byers 1981: 10, larval diagnosis.

Description.—*Egg*: Length: 0.7 mm; width: 0.4 mm. Black, surface of chorion smooth, with no terminal filament.

First instar larva: (Fig. 5). Length: 2.0 mm; width: 0.2 mm. *Head*: pale, but similar to fourth instar. Antenna a single segment, granulose. Mandible with proportionally larger basal tooth, mandible appearing equally bifurcate. Hypopharynx with three teeth, lateral teeth divergent, median tooth highest and broad. Maxillary cardo with two sockets (setae not evident). *Thorax*: Mostly with fine, appressed, short hairs in closely-set distinct transverse rows. *Abdomen*: Sparse covering of scattered, erect short, pale hairs; macrosetae longer, slender and pale. *Spiracular region*: With eight apparent lobes, a single pair each of dorsal and ventral lobes, and divided lateral lobes; ventral lobes broadest and pigmented. Each lateral lobe with a narrow upper part and broader lower part. Apical margin of each dorsal lobe with two groups of long hairs, each group emanating from single base. Dorsolateral lobes each with apical margin of long hairs, each ventrolateral lobe with one long seta, and one short sensory peg, remainder of margin with hair. Apical margin of each ventral lobe with four major groups of hairs, each group emanating from single base, three smaller groups and a single, short, forked hair. Spiracles each with about 10 pores. Two oval,

raised ventrolateral swellings large and conspicuous.

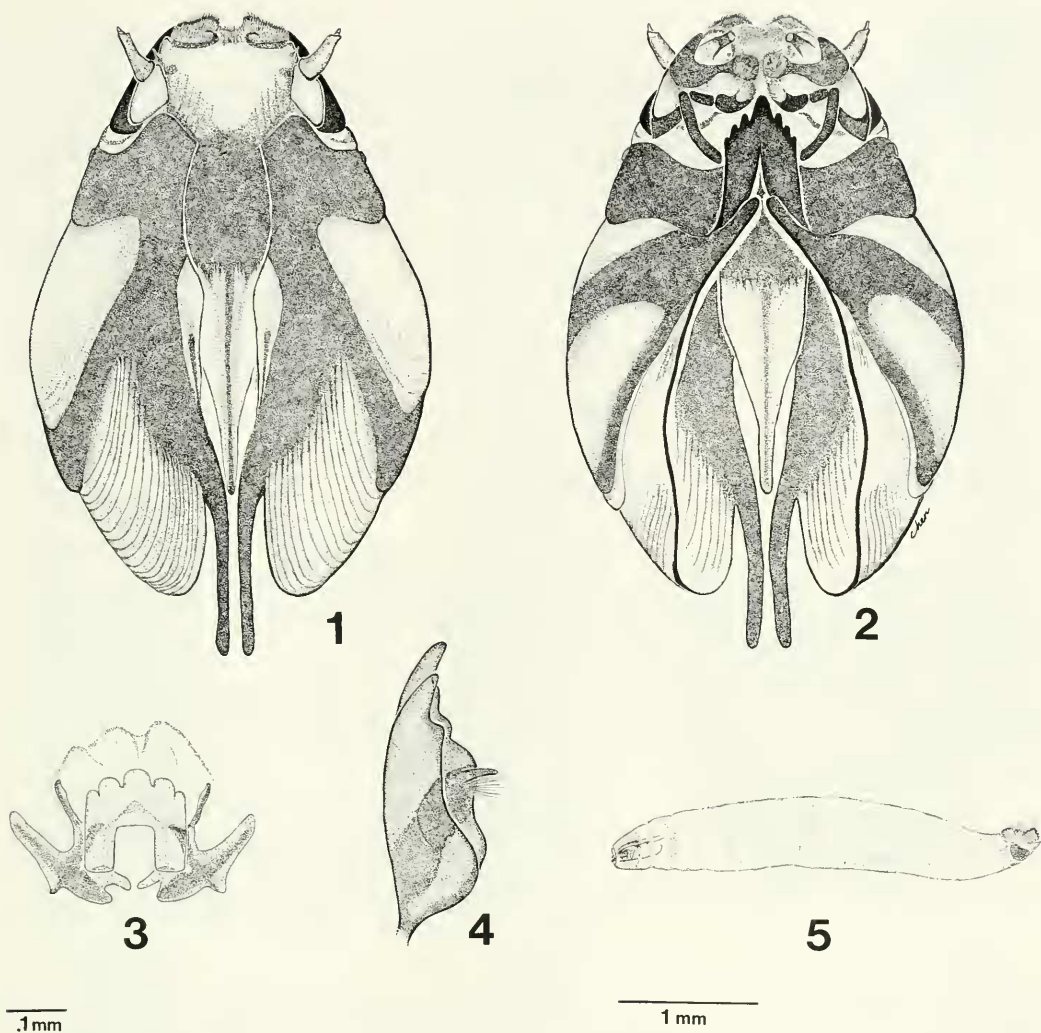
Fourth (final) instar larva: Length 15.0–18.5 mm, width 2.3–2.8 mm. *Head*: Massive, well-sclerotized, oval-shaped and slightly depressed (Figs. 1, 2). Each antenna about 3× as long as wide. Four sensory pores laterally at boundary of frontoclypeus, with several others clustered opposite base of each antenna; no setae on frontoclypeus. Anterior margin of head dorsally divided by pair of sclerotized bands, enclosing lateral areas of epipharynx, basal half of enclosed area with pair of sensory pores, apical half with fine yellow hair and scattered sensory blades. Mandible with two distinct teeth apically, an additional tooth ("molar ridge," Byers 1961) and hair tuft ("brustia," Byers 1961) near base (Fig. 4). Maxilla as in Fig. 2, paired setae on cardo extremely sort and inconspicuous. Hypopharynx (Fig. 3) with five rounded teeth; hypostomal bridge (Fig. 2) with seven, relatively acute teeth. *Thorax*: Pro-, meso- and anterior one-fourth of metathoracic segments completely covered with microscopically short, fine, brown pubescence, contrasted with long, patchy macroscopic hairs found elsewhere on metathorax and abdomen (Fig. 6). Macrosetae extremely short, pale and difficult to see. *Abdomen*: Macrosetae dark and uniformly short (difficult to see among the hairs), placement as in Figs. 7 and 8. Macroscopic hairs elongate and abundant, dorsally arranged in six or seven irregular transverse rows of patches, the longest hairs dark, obscuring the macrosetae, all others reddish brown (Fig. 7); hairs similarly arranged but less abundant ventrally (Fig. 8). Short hairs scattered throughout. Lateral hairs in nearly continuous longitudinal fringe or row, best seen viewed dorsally or ventrally (Figs. 6, 10); longest hairs completely encircle posterior edge of segment VIII. Spiracles small, dark, oval located above lateral setae on each segment I–VII (in addition to large terminal pair on spiracular disc). *Spiracular disc*: Small and strongly invaginated me-

dially. Six short lobes encircling disc, lateral and ventral lobes each about as long as width at base, dorsal lobes scarcely evident, with length half basal width (Fig. 9). Posterior surface of each dorsal lobe smooth and lightly sclerotized, sclerites extending between spiracles; each lobe with a border of short dark hair around apex and meeting between lobes. Posterior surface of each lateral lobe brown, surrounding a subcircular translucent area; each lobe black on apical half, with brush of brown stout hairs at apex. Posterior surface of each ventral lobe shelf-like with sclerite at base below spiracles, apical half of lobe black with large, subcircular, translucent spot subapically, two long macrosetae arising within each spot. Each ventral lobe with a border of dark hair around edge. Spiracles flat and nearly quadrate. A patch of long hair anteriorly between dorsal and lateral lobes with shorter hair continuing to near ventral lobes, short hair in two isolated bands extending anteriorly to dorsal lobes, and also below anus. Anal papillae absent from around the anus. A pair of oval, darkened, raised areas ventrolaterally on segment VII (Fig. 10).

Pupa: Length 16.2–18.6 mm, width 2.8–3.0 mm. Overall dark reddish brown, darkest sublaterally along abdomen. *Head*: Antennal sheath expanded along first four segments with distinct tubercle at base. Sheaths of maxillary palps short, slightly curved overall (not recurved as in other Tipulinae), apices lying close to those of antennal sheaths (Figs. 12, 13). Sheaths of labial palpi separated and indented medially, apices slightly divergent. *Thorax*: Respiratory horn 1.0–1.4 mm in length, with slight bend at midlength and minute annulations along entire length (Fig. 11), apex darkened with transverse series of small pores. Dorsum of thorax with three pairs of large tubercles in transversely oblong arrangement, a pair of low tubercles located further posteriorly, another pair laterally at base of each wing sheath (Figs. 11, 13). Leg sheaths

reaching to venter of abdominal segment IV, sheaths of prothoracic legs the shortest (Fig. 12). *Abdomen*: Slender spines laterally and along posterior margins of all segments, spines elongate and thin, about one-third length of abdominal segment III (Fig. 11). Two spines laterally on II–VII, with a small tubercle located between (Fig. 12). Dorsal spines along posterior margin of segments, four spines on I (two long, two short), 5–6 on II–VII (four long, Fig. 11); ventral spines also along posterior margin, two large spines on III–IV, four large spines on V–VII, a pair of minute spines anterior to these on III–VII (Fig. 12). Terminal segment with two pairs of elongate spines, one pair directed dorsally, one pair posteriorly, posterior spines each with small tubercle near base; two pairs of short spines anterior to both large spines and to genital sheaths (Figs. 14, 15). Genital sheaths ventral to large spines; male sheaths a single pair, short, and slightly curved, with constrictions at midlength and subapically (Fig. 14); two pairs of closely appressed female sheaths (Fig. 15). Minute spiracles sublateral on each segment III–VII, posterior pair on terminal segment exposed and larger.

Specimens examined. U.S.A.: D.C.: Washington, May 1913, R. C. Shannon, head of pupa (UMAA). Florida: Alachua Co., no specified locality, J. S. Rogers, larval head capsule (UMAA); Highlands Co., Archbold Biological Station (near Lake Placid), outflow stream of Anne Lake, IV-15-1989, J. Gelhaus, C. Young, 6 larvae, 2 pupae, 5 larval and pupal skins (reared). Highlands Hammock State Park, small stream, IV-16-1989 (female collected), J. Gelhaus, C. Young (eggs and first instar larvae); Putnam Co., Welaka, R. E. Bellamy, Jr., larval headcapsule (UMAA). We have deposited specimens in the collections of the Academy of Natural Sciences, Philadelphia, PA; Carnegie Museum of Natural History, Pittsburgh, PA and Snow Entomological Museum, Lawrence, KS.



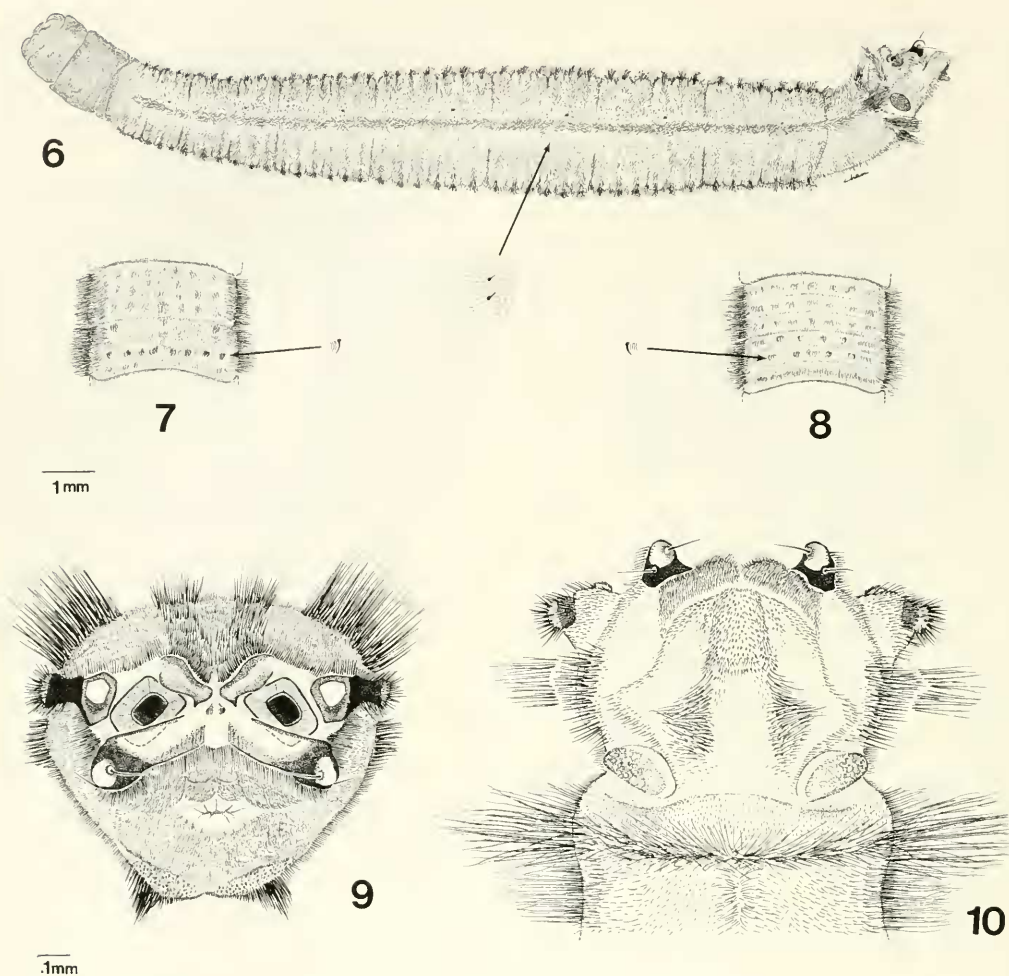
Figs. 1-5. *Brachypremna dispellens* larva. 1, head, dorsal. 2, head, ventral. 3, hypopharynx, ventral. 4, mandible, ventral. 5, first instar larva, lateral. Scale: 1 mm, Figs. 1, 2; 0.1 mm, Figs. 3-5.

Brachypremna sp.

Although reared to pupal stage, the male genitalia of the pharate adult were not completely developed in the single specimen to allow identification. In addition, eight species of this genus have been recorded from Peru, with several species occurring at the same locality where this single larva was taken.

Description.—As in *dispellens* except as follows:

Fourth (final) instar larva (from exuvium): Body length 16.0 mm; width 2.7 mm. Macroscopic hairs on dorsum of abdomen reddish brown, longest hairs not darkened. Long hairs anterior to spiracular disc extending ventrally as semicircular fringe between dorsal lobes and anterior to anus, all hairs in fringe equally long.



Figs. 6-10. *Brachypremna dispellens* larva. 6, habitus, lateral, inset showing lateral macrosetae. 7-8, typical abdominal segment, dorsal and ventral, inset of macroseta. 9, spiracular area. 10, terminal abdominal segments, ventral aspect. Scale: 1 mm, Figs. 6-8; 0.1 mm, Figs. 9, 10.

Pupa: length 15.8 mm; width 2.8 mm. Respiratory horn not so strongly bent, length 1.2 mm. Dorsal spines on I-II subequal in length. Male genital sheaths short and thick, without subterminal constriction.

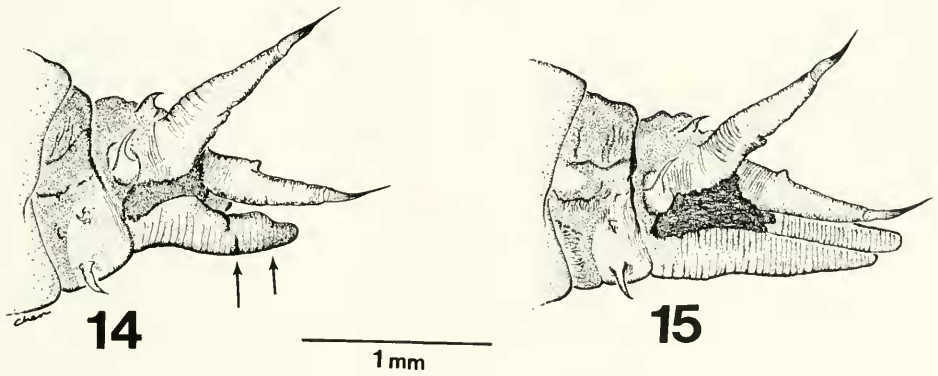
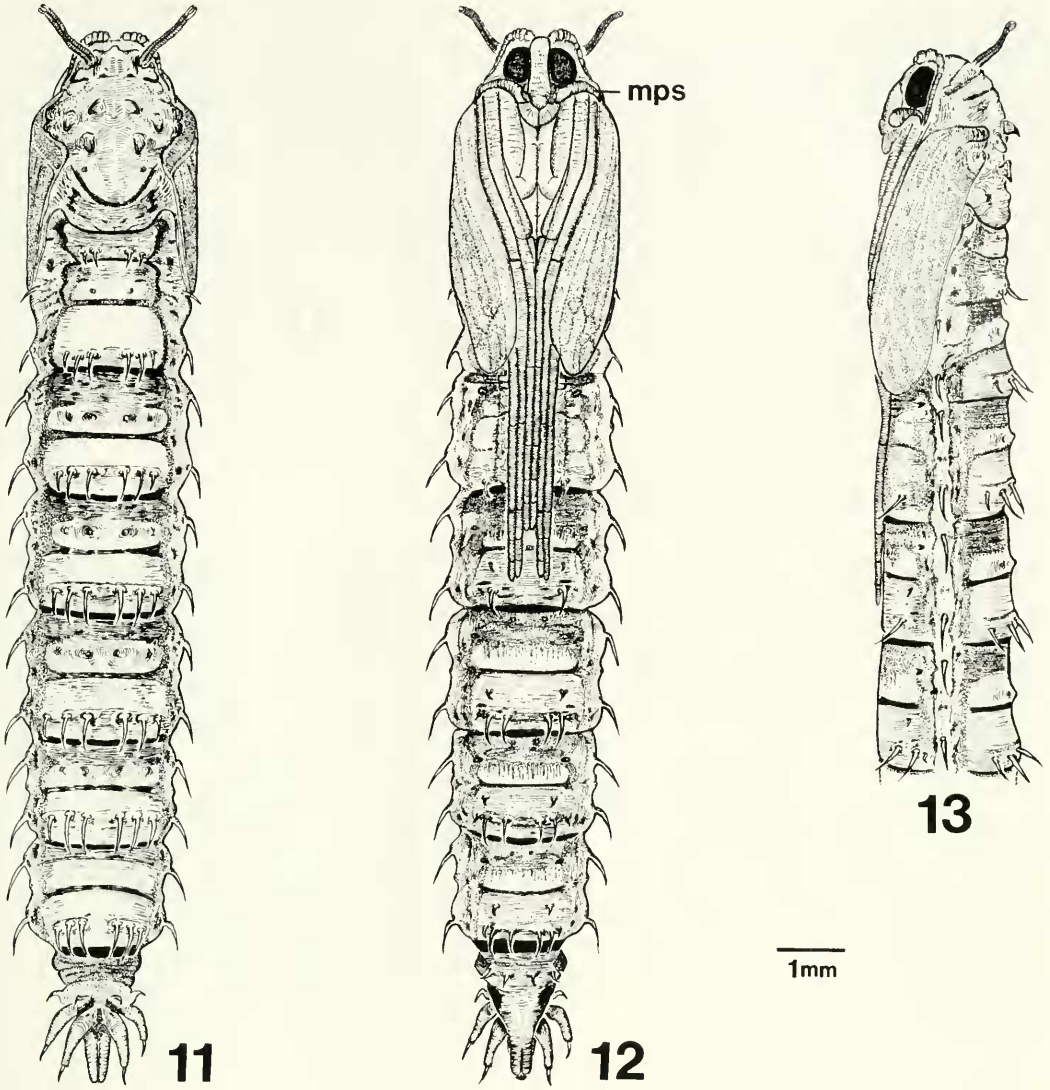
Specimens examined. Peru: Madre de Dios: Parque Manu, Pakitza, elev. 250 m, seepage area, IX-17-1989, J. Gelhaus, larval skin, pupa (Academy of Natural Sciences, Philadelphia).

Discussion.—The immatures of the two known species of *Brachypremna* may be easily separated by the distinguishing char-

acters listed in the description of the Peruvian species.

BIOLOGY

Habitat: Virtually our entire knowledge of the larval habitat of *Brachypremna* is derived from the widely distributed species, *dispellens*. Although the first known larva was taken from a log near a stream (Alexander 1920), Rogers (1949: 13) reported that larvae were taken from "wet to saturated black organic soil of seepage areas, damp shaded stream banks, or low, wet grass-



Figs. 11-15. *Brachypremna dispellens* pupa. 11-13, habitus, dorsal, ventral, lateral; mps—maxillary papal sheath. 14-15, terminal abdominal segments, lateral; 14, male; 15, female. Scale: upper, Figs. 11-13; lower, Figs. 14-15.

lands. They occur beneath the liverworts or damp moss mats of swamp hummocks and beneath and among the matted stolons and roots of the luxuriant carpet grass sods of low, wet, meadow-like situations."

We collected larvae of *B. dispellens* by sieving the soil of a heavily shaded bank along a small sandy stream; the soil was damp, dark humus, with little sand and many fine plant roots. Surrounding areas of more sandy soil contained no larvae. Soil had a slight cover of leaf litter, and the larvae were found within 3–4 cm of the soil surface.

The single larva of the species found in Peru was collected from the surface of saturated mud under a thin layer of leaf litter in a densely shaded seepage area.

Developmental time: Larvae of *dispellens* collected in mid-April began pupating by late April; the pupal period ranged from 10–14 days. Eggs were obtained from a single female of *dispellens* and took 30 days to hatch.

Food: Because of the sluggish nature of the larvae and the difficulty of observing them in soil, no direct observations were made on larval feeding in either species of *Brachypremna*. Fecal pellets of *dispellens* were examined, though, and were found to consist of recognizable plant fragments, probably derived from leaf litter.

Larval behavior: As noticed by Rogers (1949), larvae of *Brachypremna* are extremely sluggish. For example, in the laboratory, one healthy larva of *dispellens* remained still and curled on the soil surface for over 40 minutes, although most tipuline larvae would have burrowed away from the light within a few minutes. This unresponsiveness, combined with the "dirty" appearance of the larva (due to the trapping of soil among the long body hairs), make larvae extremely difficult to detect in the soil, except by sieving the soil with water. Even first-instar larvae of *dispellens* were noticed to have debris adhering to them although they possess only a sparse covering

of the long hairs seen abundantly in later instars.

The larvae of both species have the curious habit of propelling the fecal material into the air, even while remaining in the soil, and the lid of any rearing chamber quickly becomes fouled with many fecal pellets. This behavior has been seen in other, mostly semi-aquatic, tipuline larvae, particularly species of *Tipula* (*Yamatotipula*), and can serve as an easy way to determine positions of the larvae in the soil in the rearing dishes. In natural situations, though, this peculiar behavior may serve the opposite purpose.

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